Eight is enough DRAFT#1 June 19, 2002
Richard

Content: Students use ChemSense to learn that atoms bond in such a way to obtain 8 valence electrons (the octet rule).

Time Required: 45 minutes

Target student audience: Year 1

College prep chemistry

ChemSense User Level: Beginning

ChemSense Tools used: Drawing tools

Text notes - summarize

Context: Students have mastered the bonding patterns of hydrogen, oxygen, nitrogen, carbon and three halogens. They have learned that each line in a structural formula represents a bonded electron pair and that unbonded electron pairs are not represented with lines but may still exist around an atom.

Chemistry Concepts in Activity (linked to CA stds, NSES, Benchmarks, ChemSense 5 themes):

Valence electrons: part of NSES Content Standard A/Structure and Properties of Matter
Octet rule: part of NSES Content Standard A/Structure and Properties of Matter

Pre-requisite Chemistry Concepts: structural formulas, electron pairs

Inquiry Skills

Identify questions and concepts that guide scientific investigations (NSES)

Formulate and revise scientific explanations and models using logic and evidence (NSES)

Communicate and defend a scientific argument (NSES)

ACTIVITY Summary:

1. ChemCatalyst: Draw the Lewis dot structure for Cl_2.
2. Concept introduction: Review of Lewis dot structures of diatomic halogens
3. Activity: Draw Lewis dot structures of additional molecules
4. Discussion: Introduction of octet rule

5. Check-in: application of octet rule to new compounds.

ACTIVITY

1. ChemCatalyst

   Students draw the Lewis dot structure for Cl_2.

2. Concept introduction

   Review the Lewis dot structures of other diatomic halogens, such as F_2, I_2, Br_2. Review rules discussed in previous lesson about counting the number of valence electrons and joining atoms at unpaired electrons to form covalent bonds.

3. Activity

   Students draw Lewis dot structures of Br_2, H_2S, PH_3, SiH_4 using the ChemSense drawing tool. As opposed to the previous lesson, this time the students create the structures from scratch. Students are not provided with pre-made atoms with the correct number of valence electrons.

   Students answer inquiry-oriented questions related to the structures they have drawn. These questions integrate their previous knowledge of bonding patterns of atoms with the recently acquired knowledge of valence electrons and element group numbers.

4. Discussion

   Students share and discuss activity results.

   Introduce the octet rule: atoms tend to form bonds by sharing electrons until eight electrons surround each atom.

   Students count numbers of electrons around each atom in the structures they drew during the lesson activity.

5. Check-in

   Students evaluate the following molecular formulas to determine whether they follow the octet rule and the HONC 1234 rule: CH_3, NH_3, CH_4, NH_4. In this way, students apply their new knowledge of the octet rule to a new context and integrate it with previous learned concepts.

Rubric/s for scoring:

Activity

Insufficient mastery	Structures do not show eight valence electrons around each central

	atom. Structures have the overall incorrect number of valence electrons (i.e., students have added electrons in order to satisfy octet rule). Students add unnecessary electrons around the hydrogen atom.
Basic mastery	Structures show the correct number of valence electrons around each central atom. Students demonstrate the ability to relate Lewis dot structures to the number of bonds formed.
Exceptional mastery	Structures show the correct number of valence electrons around each central atom. Students demonstrate the ability to relate Lewis dot structures to the number of bonds formed. Students successfully answer the challenge question.

Links: Living By Chemistry, Lawrence Hall of Science, UC Berkeley, Unit 2, Investigation II, Lesson 4

Integrated Uses: